"I hereby declared that I have read through this progress report and found that it has comply for Bachelor Degree Project (PSM) and partial fulfillment for awarding the degree of Bachelor of Electrical Engineering
(Control, Instrumentation & Automation)"

Signature : ----------

Supervisor's Name : EN. MASLAN BIN ZAINON

Date : MAY 2008

DESIGN AND CONSTRUCTION OF AN AUTOMATED SYSTEM FOR PARTS ASSEMBLY MACHINE

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Thesis submitted in accordance with partial requirements of the

Universiti Teknikal Malaysia Melaka for the

Bachelor of Electrical Engineering

(Control, Instrumentation & Automation)

Faculty of Electrical Engineering

Universiti Teknikal Malaysia Melaka

MAY 2008

DECLARATION

"I hereby declared this progress report for Bachelor Degree Project (PSM) entitled "Design and Construction of An Automated System for Parts Assembly Machine" is the result of my own research and design as except as cited in the references"

Signature : ----------

Name : MOHD ZAIM BIN ZULKIFLI

Date : MAY 2008

APPRECIATION

Alhamdulillah, grateful to *Allah S.W.T* with *Allah* blessing I manage to finish my research and development of my Bachelor Degree Project and progress report for my Bachelor Degree Project (PSM).

I would like to thank especially to my beloved family for their unending support since I in Universiti Teknikal Malaysia Melaka (UTeM). My PSM supervisor En. Maslan Bin Zainon , Tn. Hj. Mohd Anim Bin Mohd Tanim, Mr. Koh Hock Poh , Mr. Yiang Soo Keong, Mr. Amat Sawal, Mr. Soo Teck Ming, Mr. Mohd. Fauzi, Mr. Mohd. Khairul (Fujitsu Component Malaysia) and all UTeM member & friends for all the support and help that has given.

Lastly, I also would like to thank to all the people who involved directly or indirectly with my Bachelor Degree Project (PSM).

Thank You□.

PROJECT ASBTRACT

This project is about design and construction of an automated system for parts assembly machine. The main function of this machine is to join base and cover of product parts together. It consists of a complete system such as air blower section, shape and position checking sections, control and display sections, as well as automatic loading and unloading sections. The machine starts when the product is loaded at unloading unit, then it will be transferred to join unit and after all process are completed it will end at the loading unit and ready to be sent to the next production process. Standard parts like table slide cylinder, rotary set cylinder, solenoid valve set, PLC, various types of sensors, air supply unit, electro-pneumatic gripper and other parts of standard actuators will be used in this project. All the standard parts and machine drawing will use Autodesk Inventor Series 9 program, machine wire-ring and layout will use Microsoft Visio 2003 program and PLC programming will use Keyence Ladder Builder Editor V1.51 program. The outcome of this project includes hardware and software program that will fulfill the requirement for PSM.

ABSTRAK PROJEK

Projek ini adalah mengenai mereka bentuk dan pembangunan perkakasan bagi aplikasi sistem automatik (*automated system*) untuk mesin pemasangan bahagian produk (*Parts Assembly Mahine*). Fungsi utama mesin ini adalah untuk mencantumkan bahagian produk iaitu bahagian tapak (*base*) dengan bahagian penutup (*cover*) produk. Ia juga lengkap dengan sistem semburan angin (*air blower system*), sistem pengesanan bentuk dan kedudukan (*shape and position checking system*) dan juga sistem masukan dan keluaran automatik (*automatic loading and unloading unit*). Mesin ini bermula apabila produk di masukan pada unit keluaran (*Unloading Unit*), kemudian dipindahkan ke bahagian pencantuman (*Join Unit*) dan selepas semua proses selesai, produk akan berakhir pada unit masukan (*Loading Unit*) untuk proses seterusnya. Komponen – komponen yang lazim digunakan (*Standard Parts*) seperti silinder, set injap angin, pengawal logik aturcara (*PLC*), pelbagai jenis pengesan (*Sensors*) dan sistem elektro-pneumatik akan digunakan menjayakan projek ini. Program AutoDesk Inventor Series 9 akan digunakan untuk melukis komponen dan bentuk mesin dan Program Microsoff Visio 2003 akan digunakan untuk melukis kedudukan komponen elektrik dan sistem pendawaian mesin. Diharap hasil daripada projek ini terdiri daripada perkakasan (*machine*) dan perisian (*Program PLC*).

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Today's manufacturing plants must operate faster, more efficiently, and with more flexibility than ever before due to the increasing of industrial needs. The evolution of standards for controllers has been a steady march toward open systems. For the machine tool industry, the march began about 40 years ago with the development of RS274 standard for G and M-codes for programming computerized numerical controls (CNC). It was a boon for the industry.

"Capital investments for automation are expected to remain strong across many industries during the five-year period. It is clear that manufacturers have come to rely heavily on automation technology as they work to optimize their operations to maximize productivity and profitability in an increasingly competitive global manufacturing environment. As a result, the demand for PLCs will grow robustly," says Himanshu Shah, an ARC senior analyst and the principal author of the report, titled "Programmable Logic Controller Worldwide Outlook."[1]

Industrial automation or numerical control is the use of control systems such as computers or PLC to control industrial machinery and processes. Currently, industrial automation becoming increasingly important to full fills the production needs. Almost any production line, machine function or process can be automated using a PLC. The speed and accuracy of the operation can be greatly enhanced using this type of control system. There is great benefit in observing a PLC program during the start- up and testing phase. Being able to select and monitor different PLC programs from the same location is very useful.

1.2 PROJECT OVERVIEW

This project is about design and construction of an automated system for machine parts assembly. The tasks start from research, than development, execution and end with analysis of the project.

The main function of this machine is to join base and cover of product parts together. It consists of a complete system such as air blower section, shape and position checking sections, control and display sections, as well as automatic loading and unloading sections. The machine starts when the product is loaded at unloading unit for both part relay part and cover part, then it will be transferred to join unit for attachment process and after all process are completed it will end at loading unit and ready to be sent to next production process.

Standard parts like table slide cylinder, rotary set cylinder, solenoid valve set, PLC, various types of sensors, air supply unit, electro-pneumatic gripper and other parts of standard actuators will be use in this project. All the standard parts and machine drawing will use Autodesk Inventor Series 9 program, machine warring and layout will use Microsoft Visio 2003 program and PLC programming will use Keyence Ladder Builder Editor V1.51 program. The out come of this project include hardware and software program that will fulfill the requirement for PSM.

1.3 PROJECT OBJECTIVES

(1) To implement the automatic loading and unloading system, parts assembly system, position and shape checking system in one machine.

(2) To implement the hardware installation, electrical wiring and mechanical component to control the system sequence.

(3) To build a prototype of an automation machine as a learning kit for teaching and learning purposes.

(4) To be able to make programming for Programmable Logic Controller (PLC) for an industrial machine.

(5) To acquire experiences in collecting technical data and information, system design, electrical and mechanical drawing, assembling, wiring and troubleshooting.

1.4 PROJECT SCOPE

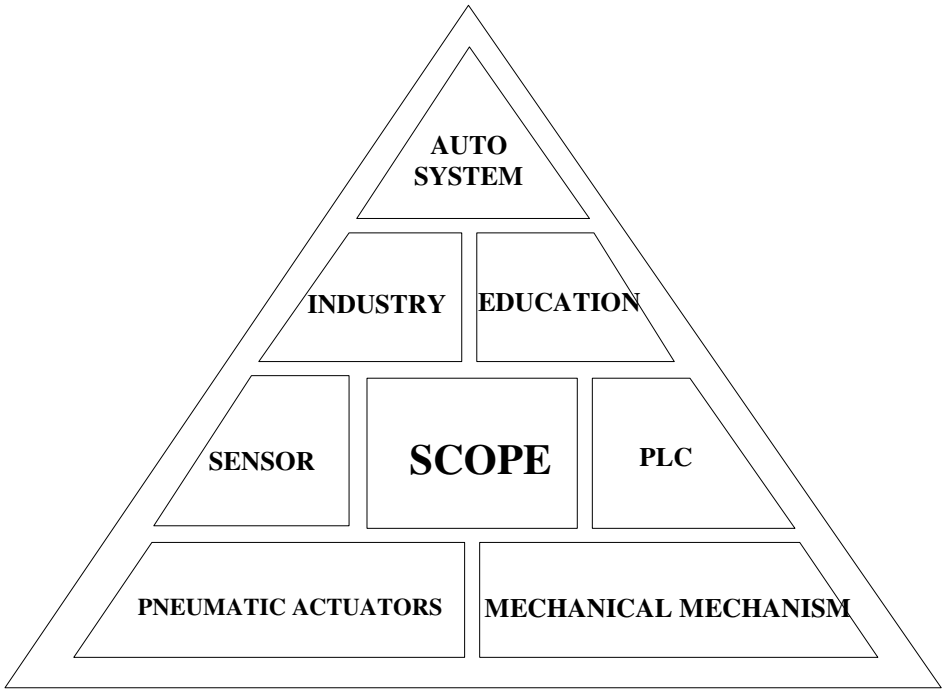

Figure 1.1: Pyramid Scope

Generally, all projects have their own scope or limitation as a guideline. The project scope for this project is:

(1) Assembly process system for small parts component of the product (Relay P3 type from Fujitsu)

(2) To build a prototype of an automation machine as a learning kit for teaching and learning purposes.

(3) The use of Programmable Logic Controller (PLC) to control machines and automation of industrial processes.

(4) The used of various type of sensors in determine the type, shape and location of the product and making decisions.

(5) The combination of pneumatic actuators and mechanical mechanism in handling and movement of the product.

1.5 PROBLEM STATEMENTS

(1) The increasing of production cost.

- Production cost includes of material cost, labor cost, operation cost and extra cost thought the production process. In Malaysia industrial sector, operator cost is increasing due to strengthen of our economy and currency exchanging.

(2) The decreasing of the product quality and product efficiency.

- When production side use operator as their main medium for production process, there will be many sequences due to human natural capability and response. In simple word, each person has their own way of handling production process. So, the quality is not the same and not standardizes.

(3) Limited time for product production process.

- When demand of the product increase extremely, time of production is the main concern. A person cannot work 24 hours a day, 7 days a week. Thus, many workers are needed to complete the task.

(4) Lack of educational kit.

- The laboratory at the faculty only has few pneumatic actuators for teaching and learning kit. For more effective way in teaching and learning purpose, the laboratory should have a complete an automated machine.

1.6 PROJECT METHODOLOGY

The project methodology is a part that explains about the project path from the beginning until it is completed.

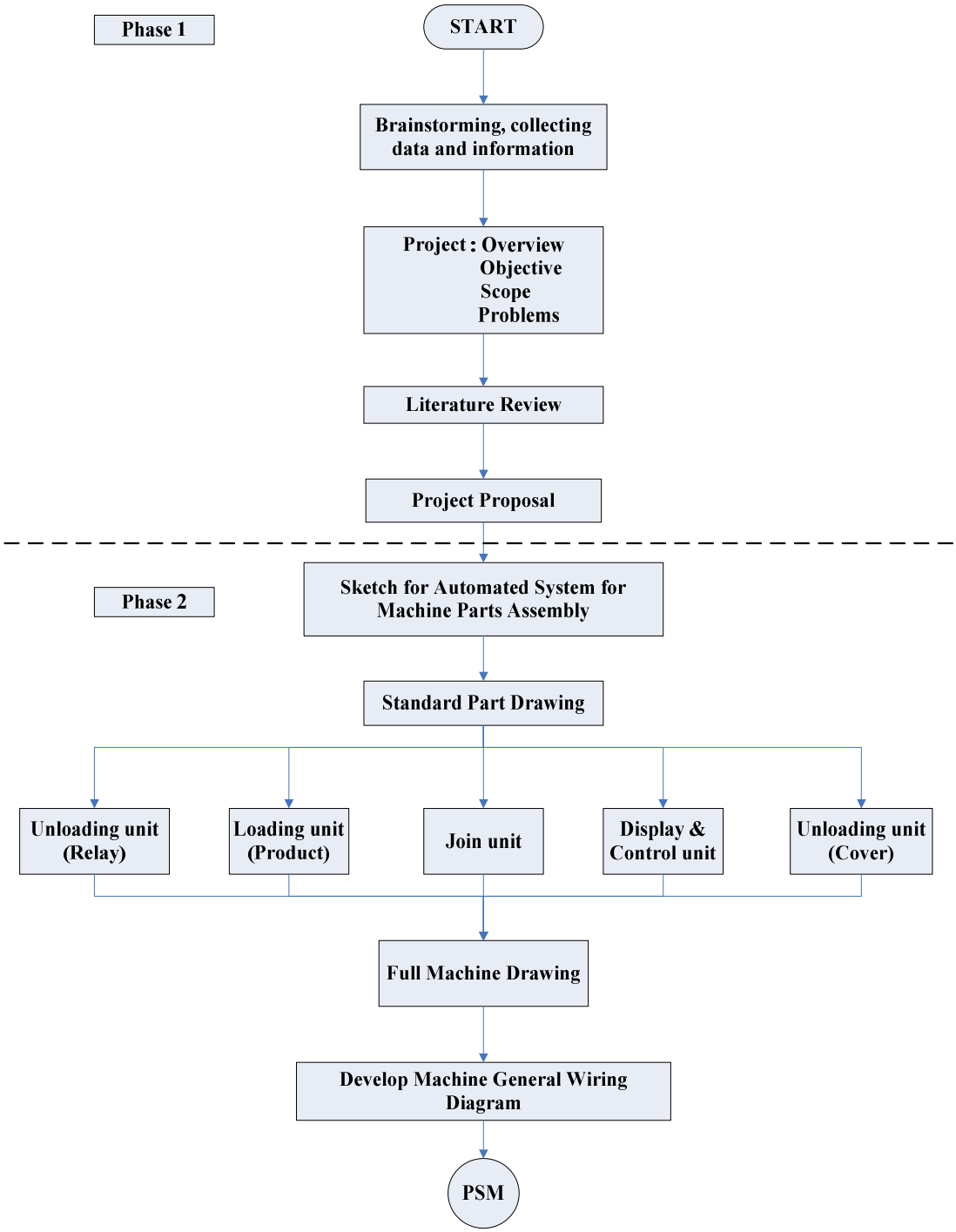

Figure 1.2: Project Methodology Graph Flow

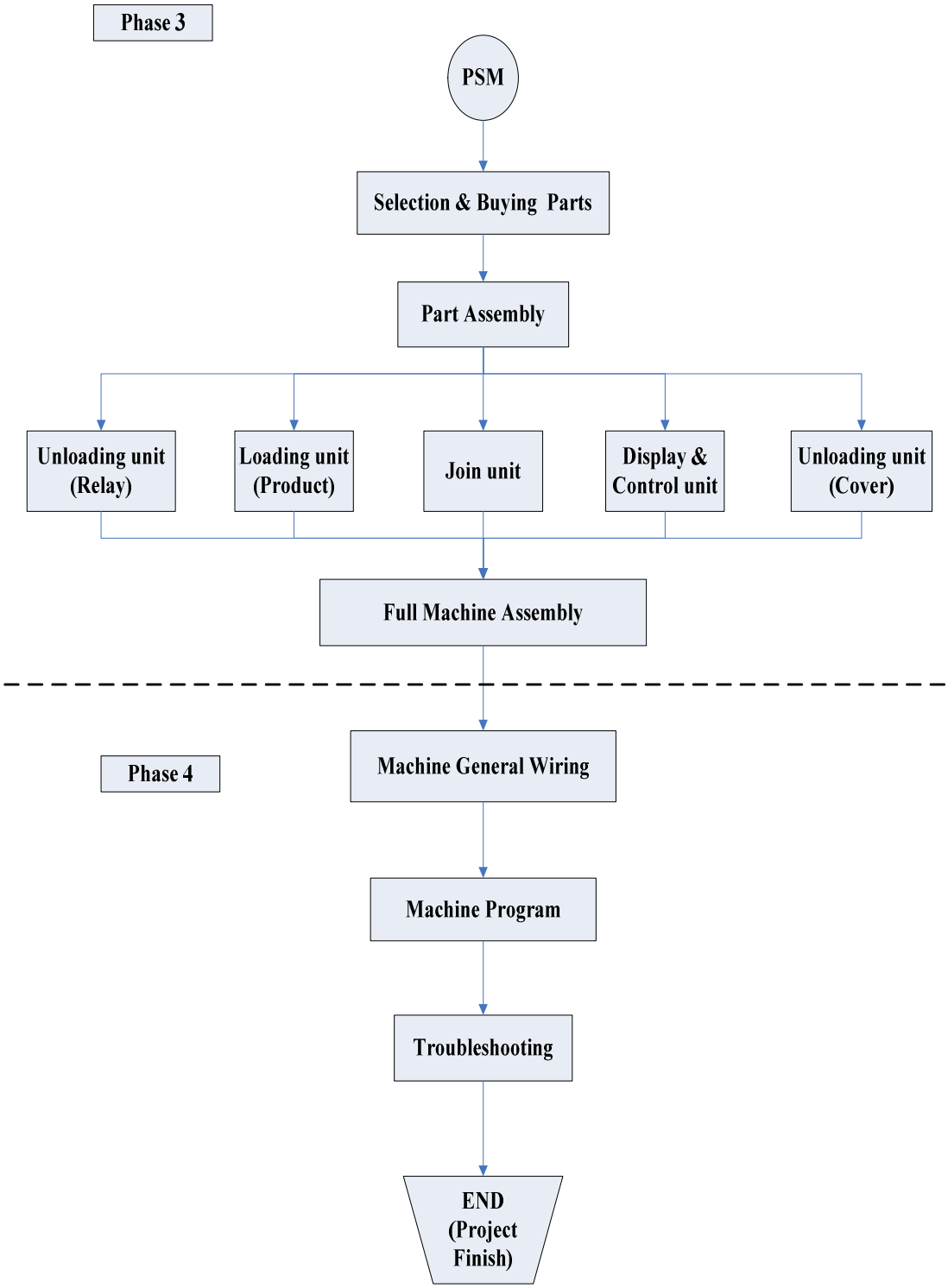

Figure 1.2: Project Methodology Graph Flow (continue)

1.7 PROJECT PLANNING

PROJECT PLANNING													
Project's Activities	2007							2008					
	J	J	A	S	O	N	D	J	F	M	A	M	J
Title Selection & Preparation													
Brainstorming, Collecting Data, Information and Literature Study													
Project Proposal													
Report Writing for PSM 1													
PSM 1 Presentation													
Development of Hardware & Software													
Testing, Troubleshooting and Commissioning													
Preparation for Final Presentation													
Report Writing for PSM 2													
PSM 2 Presentation													

Figure 1.3: Project Planning Gant Chart

The methodology for this project is divided to 4 phase (as shown in figure1.2). The Phase 1 is the research stage. The research stage start with suitable title for this project is chosen. From brainstorming to collecting data and information parts is very importance to be able to understand about the project clearly. After that, the project overview, project objective, project scope and project problems can be determined. Literature review parts are where past or current project that available in market is being study as references. After all researches are done, project proposal are being sent to the faculty to acknowledge about the project.

Phase 2 is the planning stage. The planning stage starts with sketching drawing for the machine to illustrate all the idea. Than, standard part drawing for each unit can be draw in solid-work type drawing (3D drawing). The unit consists of Unloading unit (Input-Relay), Unloading unit (Input-Cover), Loading unit (Product Output), Join unit and Display & Control unit.

Phase 3 is the execution stage and phase 4 is the finalist stage. With this methodology flow, planning according to month are being set up, please refer to figure 1.3. The project planning starts from July 2007 (Sem 1 2007/2008) and will end with the complete hardware and software of the machine around May 2008 (end of Sem 2 2007/2008)

CHAPTER 2

LITERATURE REVIEW

This chapter is consisting of explained and reviews of the past project that has been done before by other parties. It consists of few projects in the market for industrial purpose and training kit for education purpose from various types of companies that involve in automation industrial.

2.1 FIRST REVIEW: DIXON STANDARD MODEL AP-120 MACHINE

Figure 2.1: Dixon Standard Model AP-120 Machine

The machine components include two Dixon Standard Model AP-120 Part is a Semi-Automatic Four Station Dial Index System Assembles Four Knurled Studs Into A Motor End Bell Housing. Placers, a Dixon Standard Model AO-700 hydraulic press, vibratory feed system, light curtains, and programmable logic control. Parts are manually loaded onto fixtures consisting of housing locators and tools designed to form the stud ends into the housing counter bore. Parts are automatically stripped from the crimping die and ejected. The machine employs Dixon's Assemble Perfect® technology to provide assurance of "Good Assemblies."[10]

2.2 SECOND REVIEW: MICRO-ASSEMBLY MACHINE

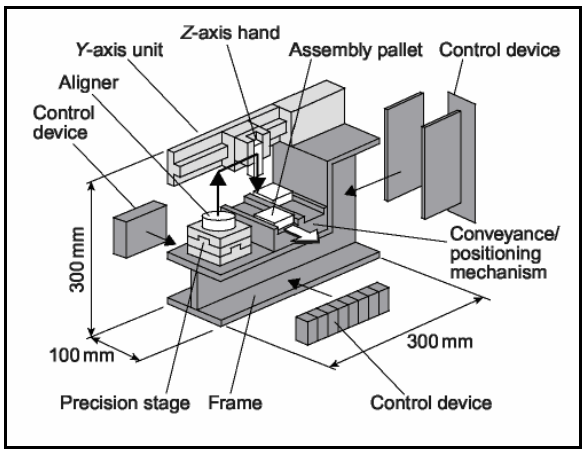

Figure 2.2: Fujitsu Low-Cost Micro-Assembly Machine

Recently, production demand in manufacturing industries has changed drastically from demand for high-mix, low-volume production to that for high-mix, variable-volume production. At Fujitsu, they are promoting innovative engineering through the effective use of existing equipment without the need for additional investments. Two major themes of manufacturing in the future will be the creation of strong production systems that can adapt to market changes while holding down investment and eliminating waste and the development of equipment suitable for those changes. [1]

Machine comprises the following three elements:

- A frame with a built-in unit that is used for both multiple parts mounting and assembly processes and a common base comprising the conveyance/positioning mechanism.
- A precision stage selection base equipped with Y-axis and alignment mechanisms for selecting the operating stroke and load-bearing capacity according to the process conditions.
- A custom aligner/Z-axis hand unit. The basic configuration is pick-and-place.